

SHORT TALKS
TO PRINCETON STUDENTS
ON
LIBERAL STUDIES

Reprinted from *The Daily Princetonian*

PRINCETON UNIVERSITY PRESS
1917

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Pres.
L. N. Frost

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The articles gathered together in this pamphlet were first published in *The Daily Princetonian*. They were merely offhand talks to the undergraduates explaining the purpose and value of a liberal education as a whole and the relation which the courses in each of the various departments have in a scheme of liberal studies. Their immediate value lies in the fact that they are the expressions of men of large educational experience in advocacy of the Princeton system.

JARVIS CROMWELL,

Editor of *The Daily Princetonian*.

May, 1917.

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THE PURPOSE OF PRINCETON EDUCATION

By JOHN GRIER HIBBEN
President of the University

The articles comprised in this book present the nature and scope of our studies at Princeton. There is one common end in our teaching activity to which all our departments are tributary, namely, the bringing of the young man into the full possession of his powers. The richly stored and trained mind, the trustworthy character, the spirit of ambition set upon attainment, and the spirit of consecration willing to devote that attainment to the welfare of the world, these are the fruits by which any scheme of education is to be known and judged. As far as we can consciously interpret our aims and endeavor, this is the standard which we hope to realize here in Princeton.

SHORT TALKS ON LIBERAL STUDIES

By ANDREW F. WEST
Dean of the Graduate School

I. Why Not Let the Undergraduate Take What He Wants?

Why not let every man take what he wants? Well, why not? The argument is that if a student takes what he likes, without restriction, he will do better work and be happier in it. It is very alluring. It goes to the roots of human life. If it is wholly true, as it is in part, then prescribed courses in college should be abolished as useless and fretting hindrances to freedom.

What is true in it? This much—that there is a sense, a higher sense, in which pleasure is the true end of human life, and a sense, a lower sense, in which pleasure is not the true end of human life. The higher sense is happiness and the lower sense is self-indulgence. And happiness means the enduring satisfaction that inevitably comes from doing what we know we ought to do, just as self-indulgence means the transient satisfaction that comes from doing whatever our desires or caprices suggest. The former progressively strengthens and the latter progressively weakens the human mind. It is the old, eternal question of self-mastery through self-control:

“When Duty whispers low ‘Thou must’
And youth replies ‘I can.’”

The pages of history are crowded with the proof of this, and the history of universities is just as emphatic. Read and see if it is not so. The records show that wherever men are free to take whatever they like, most of them follow the "line of least resistance" and crowd into the easier courses. This is specially true of the less industrious, who most need vigorous training. They are the "slackers" in college studies. The thought of work makes them weary. How apt are the famous student verses:

"We too have vexed the souls of Deans
And caught the blossoms of the flying terms."

It all comes to this, that no true freedom is ever won or kept without vigorous effort, and that the only true freedom for a man, a university or a nation is not one which is vague, irresponsible and unrestrained, but the freedom which is definite, responsible and self-restrained. To win that intellectual and moral freedom is the object of college studies. It is the question of training in the athletics of the mind. Isn't winning on a hard fought field a pleasure? Struggle, energy, discipline, skill, self-denial and patience will win even greater battles and greater pleasure in what Plato calls "the immortal conflict" for truth and knowledge.

In that conflict the undisciplined mind will be beaten. How hard it is—and how clamorous now the call for the best trained young minds in America at this time of the world's dire need! If we fail to respond here at Princeton, by sending out each year our small army of graduates as well trained as possible, Princeton will fail not only to keep its high place in our history, but to win the higher place it can so surely gain. It is not doing what a fellow feels like doing, be it hard or easy, but doing what he knows he ought to do, be it hard or easy, and at the time he doesn't feel like doing it, that turns the schoolboy who comes to Princeton into the college man, clear headed,

strong fibred, self-governed, the kind of man in whom alone the highest hopes of Princeton are contred.

This is not a freedom that comes by scattered, casual, disconnected or intermittent effort, but by steadily mastering a definite programme planned to train the mind in all its important powers, broadly, deeply and surely. It is all "in the day's work"—and every day at that. Goethe has said most nobly:

"He only earns the right to Freedom and to Life
Who daily is compelled to conquer them."

This is not a time for amateur dawdling. It is the day of reckoning, "der Tag" in a thrilling sense. And so I close this brief appeal in the old words of Augustine, written in a like day of world peril: "Expergiscere, dies adest!" "Awake, the day has come!" And Princeton today expects every man who bears the Princeton name to do his pleasure some, and his duty—anyhow.

II. Vocational Studies.

Why not bring in vocational studies? This is too big a subject for a short talk. Yet a few points may be noted. There are two main kinds of education, with many intermediate shadings. The first aims to prepare a student to make a living; the second to give him all-round preparation for his whole life, including as a natural result such development of his powers as will help him to make a living also. The various forms of the first are called vocational, commercial, technical. The second is called "liberal," the education which aims to liberalize and set free all the best energies of the human mind. The first is limited, particular and immediately useful. The second is extensive, general, and not so immediately useful, though most useful in the long run. Both are good in their place and each has a place to fill.

Let us stop a moment and admit that for nine-tenths

of American boys vocational studies are about all they can get in addition to their elementary schooling; and this because they must begin to earn their living in their boyhood. Let us admit that of the remaining tenth, who can wait longer, many must get promptly a commercial or technical training—and no more. Also that many who go on to study law or medicine are forced to skip college altogether. It is a pity, for it does not usually make them as good lawyers and doctors; but it is hard necessity, and they must take what they have the chance to get—and no more. We admire them immensely, for some of them are our greatest Americans; among them, Lincoln and Cleveland. But let everyone remember that these really great and practical men were aware of the value of what they had missed, and sent their sons to college—and to the classical course.

So then, after all these concessions, the question inevitably comes up: Is vocational, commercial, technical and even professional education all we need in American life? Many seem to think so and to rate other education, especially higher education, as of “no use.” It is a false view both from the point of reason and of our national welfare. But a word on that later.

If this statement is true, then there ought to be a place for liberal college education. And if this is true, then that liberal education should be given every chance to organize itself according to its own laws in its full strength and purity, without perversion or dilution. Otherwise it does not have a fair chance to show what it is or to produce the best results. We grant this chance freely to all other forms of education and have the right to ask it for ourselves. Well, then, granting all this, yet why not mix in some vocational studies? Isn't there time? Won't the two go well together? Doesn't it make the college course more interesting? Let me answer these fair questions.

First, in the four years of college there is no more time than is needed *to do well* the liberal studies. Second, ex-

perience shows that vocational and technical studies, unless they happen to be difficult, drive out the liberal studies and weaken the college course. Also they force liberal studies to be taught in a superficially attractive way, to escape extinction in the competition. This means palming off on students an inferior article which sooner or later they will find is inferior, and usually too late to remedy the loss. Third, it may make the college course more interesting, but also less valuable as a college course, which can always be made interesting whenever it is well taught and men are willing to work. Some things are "interesting" because they are easy and seem useful. They tickle the mind for a while and leave it a little weaker to act unless it is tickled again. Does a thing have to be made easy to escape being dull?

And yet I would have every student get some vocational knowledge as a kind of avocation "on the side." It is both pleasant and useful, and does not call for severe effort. He can get a good deal of this, if he likes, by reading and trying his hand at manual skill, by vacation occupation, by a little guidance and on his own initiative. Can't a man ever learn anything unless it is formally "doped out" to him by a teacher? Yet such things, good as they are, should not be allowed to *displace* liberal studies in the college course.

III. What a College Man Should Know.

What ought a college man to know? That is, what ought he know by graduation?—taking school and college together. He ought to know something about the main problems of human knowledge and how to use this knowledge well. With this secured, he is a man of all-round education. He has a standpoint for judging everything rightly and for acting accordingly. He has a base for his whole life—and his living too.

There are four great questions which face every man

who thinks—or who does not think, for that matter. To each problem the answers are given, so far as given at all, in corresponding studies of which the student should know at least the fundamental part. Otherwise his base becomes shaky. He should also know as much more as he can, according to his ascertained aptitudes, and not according to hit-or-miss, happy-go-lucky caprice, or even his serious but uninformed choice.

There is, first, the problem of nature, the world of things outside us, the one largest world in space and time, the vast outer circle within which we live and act for our whole earthly life. The answers to this problem are written in mathematics and science in definite, consecutive order. The structure of this knowledge begins in mathematics and rises without break or crack through physics to chemistry and so to biology. The man who has the elements of mathematical reasoning and of physics has begun well, and if he goes on to chemistry and biology, he has done better. His foundation is then sound for all scientific knowledge.

There is, second, the problem of mankind, the world of persons outside us, the large but nearer inner circle within which we must live and act, unless we retire to a desert. The answers to this problem are written in the record of human achievement which we may call history, including history proper, politics, economics, art and archaeology, and like studies—all that deals with the collective movements of men. Here we need history first, old history forever “repeating itself” in later history, so we may get a long base line on which to measure things, a panorama of the past out of which the present has issued. The man who doesn’t know what has gone by can hardly guess right at what is coming.

There is, third, the nearest problem of all, the world of self, our own individual soul, the world within, right at the centre of the outer circle of mankind and the outmost

circle of nature. Self-expression is the first thing we get here. The unseen but seeing human mind expresses itself in many ways, but specially in what we may generically call literature. Here language becomes the one indispensable educational instrument in thought. And we ought to know at least something about the languages and literatures fundamental to our western civilization. This means and must mean the classics, for their relation is as radical to the best literary training as is the relation of physics to chemistry or history to politics. The "neglect of classics" as a principal college study is "deplorable," as President Lowell of Harvard emphatically asserts. So a student who is not to be in some sense illiterate needs some knowledge of the classics. He should also enlarge and enrich this by modern literatures in addition. Can everyone get all this? Maybe not. But at least he can try for all in his reach—and try hard.

There is, fourth, the explanation which unites the problems of nature, mankind and man's individual self in one complete view, all in due order and proportion—the Why of all our knowledge. It is philosophy. Without it the problems remain unconnected and men fail to "get the hang" of their thinking as a whole. With it the human mind attains its widest range of vision.

Such is the order of liberal knowledge. It is possible to master the elementary parts in school and college and have free time also for one's special aptitudes. This is the base on which Princeton stands. Knowledge is power, and the clearer and deeper the knowledge the greater the power.

IV. How About Elective Studies?

Is an undergraduate to have nothing but required studies? Not at all. Then, if he is to have elective studies and yet can't take whatever he wants, how about that? This is the puzzle to which so many discordant answers have been worked out that people think, with some justice,

our American colleges do not know where they stand and apparently do not know enough to be colleges at all. We must cure that trouble or our colleges will be badly damaged.

What are the answers and which is the right one?

The first is that all studies should be required. This worked well fifty years ago. It will not work now. So we need not stop to give the reasons.

The second is that no studies should be required. This is the so-called "free elective system," the famous Harvard experiment developed for forty years by President Eliot and attacked by President McCosh of Princeton. It rested on the belief that the entering student was more competent to decide what he should take in his own case than the best educational experience was competent to tell him.

We have no need here to repeat the argument, since we know the result. The experiment was conducted with skill and energy by a very able president in the one American university best able to manage it successfully. After a generation—enough time to test it—Harvard University has deliberately abandoned it. Where it was born, there it is buried. If practical men want evidence, there it is! The far seeing sagacity of President McCosh is at last justified by the verdict of time. It is fortunate that Princeton stood firm in the storm.

The third answer is that some studies should be required and some elective, and arranged or mingled in groups or selections of both. This is the so-called "group system," which has various forms, all of them unstable, and about as various as the assortment of halves, quarters and dimes you can get by changing a five dollar bill. One form of it requires the student to take the studies of a large department, with some side trimmings. It means sending the student, like a horse with blinders, down some one lane of knowledge, with only a peep here and there at any

scenery outside. This plan of rigid groups has had little success.

Then there is the plan of more elastic groups or selections, still in vogue in many colleges. Several cores or centres of studies are established, more or less variable, with varying accessories added. It is of course better than the chaos of the late "free elective system." But it is a confusing plan because it is too indefinite. It changes from college to college and never stays anywhere long enough in one form to enable us to know just what it means. I know no advocate of it who thinks it a really clear solution. It may give a college a place to halt a while, but never a place to stay. If the rigid departmental form of grouping is stiff, the more elastic forms wobble like jelly. They are today a chief cause for distrust of college courses of study.

The fourth answer is that both required and elective studies should be organized in a definite, general programme based on the nature and relations of the studies themselves and suited to the student's stage of progress. This means starting with a base of required studies, consisting of and completing the necessary, fundamental parts of that knowledge which has most general value for developing the mind. As this base rises, its area diminishes and disappears as elective studies are introduced gradually, expanded progressively and fully, and so related to the required foundation that the course of study, taken together, truly represents the system of liberal knowledge and the natural progress of the student toward complete freedom. In this way the student has the best chance to know where he is and to discover his real aptitudes, and not be lost or bewildered in the flood of studies. He is not dropped in to drown, but given a good chance to swim. This is the true way and, if space allowed, the reasons could be recited. It is substantially the Princeton plan—

imperfectly realized as yet, but we hope to be more perfectly realized soon.

Of course there will always be something to be done to bring its daily working closer to the students' needs by correcting errors of detail and ever developing it into better effectiveness. Then we always need to do better teaching, with more friendship and less pedantry—for friendship is the great awakener of knowledge. The best plan will work poorly unless it is animated and animating. Youth is youth, and calls for fire. We professors are not always sensible teachers—horribile dictu!—any more than undergraduates are always sensible learners. Our course of study calls for man's work. This done, there is plenty of time for that delightful relief from work which is our right, our recreation and the re-creation of our joy in life. The better the work, the greater the joy that follows. And this I think is common sense about studies. So I love Kipling's lines:

“Let us now praise famous men,
Ancients of the College;
For they taught us common sense,
Truth and God's own common sense,
Which is more than knowledge.”

Let me get back to my subject. To the puzzle of elective studies Princeton holds the key. It is the key to the general situation. It is ours. Don't fumble with the key. And don't lose it.

V. The Practical Value of a Liberal Education.

I previously said the view that liberal education is of little practical use is a false view. I shall try to prove it so.

We might argue that it is bound to be so from the nature of the case, and that there is another side in human life of higher value than the merely “practical” side. But

such arguing, no matter how sound, is not so quickly convincing as telling the story of what has actually happened. When we know the facts, the conclusions will draw themselves. How, then, have college graduates trained in clearly liberal studies, and with a large basis of required courses, got on in our own American life? Let us see.

It is a fact that scarcely one in a hundred of our white male youth of college age has gone to college. Call it one per cent. What has this scanty contingent done? For if on the average they have not done better than men who have not gone to college, then the colleges have failed on the "practical" side. If they have done much better, the colleges have succeeded.

First, let us look at the vast world of labor and business. It is so vast that only scattering statistics are available. Yet some things are clear to any man who has eyes to see. You rarely find college men working on the gravel train or driving trucks or serving as street sweepers, hackmen, porters, barbers, brakemen, motormen, janitors, pushcart men, farm hands, coachmen, paper hangers, gas fitters, sign painters, store clerks, gardeners, carpenters or plumbers—and such like, proper as such occupations are. And a college graduate who is a bartender is a *rara avis*—in both senses. No—they mount much higher, and everybody knows it. In the world of business, even when they start at the bottom, they are found in ascending series all the way to the top. In banking and railroads, in commerce and manufactures there is a large sprinkling of distinctly college men, much above the one per cent, and often in the directive positions. So, too, in journalism. The literary departments of our great newspapers and magazines are full of them.

Let us look next at the professions. It is true that most engineers do not have a liberal education. But ask our great engineers, like Steinmetz and Stillwell. They will tell you to take the straight college course first, classics

included, if you want the best preparation. Ask the great architects, like Cram and LaFarge. They will tell you the same. And what about the doctors, lawyers and ministers? What has our one per cent furnished? About twenty-five per cent of the doctors, forty-five per cent of the lawyers and eighty per cent of the ministers. And in the stronger schools of medicine, law and divinity, their faculties on whom the safe handing on of these great subjects depends, have nearly one hundred per cent, almost the whole thing! Thus experience shows that men trained in professional studies without an underlying liberal education are not, as a class, entrusted with the conduct of professional studies. Our one per cent has done well here.

Let us look at public life. Take the facts from the foundation of our national Government until now. On the legislative side thirty per cent of the House of Representatives and forty per cent of the Senate have been college graduates in liberal studies. Take the judicial side. Over eighty per cent of the Supreme Court, and every Chief Justice but one. Take the executive side. Over forty per cent of the Cabinet and Vice-Presidents, and over fifty per cent of the Presidents of the United States. And of the great Presidents who did not go to college, Washington, Lincoln and Cleveland gave the strongest possible evidence that they believed in liberal college education. It is an impressive roll of honor.

I do not need to go farther and take up the great roll in science, history, literature and philosophy, and in the teaching profession. Here our one per cent has gone almost "to the limit." It is the parable of the good seed in good ground all over again—some thirty, some sixty, and some an hundredfold.

What about Princeton in this performance? She has played a great part. Time would fail, if I tried to tell the story of her achievement, which began before our na-

tion existed. Princeton helped powerfully in making our nation, from the day when her President Witherspoon, alone of college presidents, signed the Declaration of Independence, and her graduates had more to do in framing the Constitution than the men of any other college. And so on and on down to this present.

All in all, then, have college men, Princeton included, done their share? The record shows that no other single class of equal numbers has done anything like so well for our country.

So in closing I beg every Princeton man who loves Princeton to stand firm as a rock on the well tested truth whereon our studies are founded—no matter what opposition may arise. Many colleges are looking to us. Let us not disappoint them. And our stand has won us deep respect wherever it is known, here or abroad. It is always a hard fight to save the best things. And it is “no place for children” when that fight arises. So when the forces of commercialism, confusion and ignorance, dressed up like the army of knowledge, start to assail the Princeton position, as they will, let us not take counsel of fear, but remember what is at stake and hold fast to the end, as gloriously as France saved Verdun. If we do not, we are disgraced. If we do, we shall win and may lead the country.

PHILOSOPHY

By WARNER FITE
Professor of Philosophy

There are several points of view from which the study of philosophy may be regarded as indispensable to a liberal education. For convenience I shall name and distinguish two; though, in the end, I should call them one.

First, from the point of view of culture. Culture, as I understand it, begins with an appreciation of the ideas and motives expressed in the lives of our fellows; and "a broad culture" implies a grasp of the ideas and motives underlying the greater movements of thought, of art and of life, as recorded in literature, history and science. That art and life, history and science, are indeed the expression of ideas, one may need some philosophy to appreciate. The scientific trend of thought which prevails at present may easily lead one to believe that the history of the race is nothing but a succession of external acts, and that science, and indeed knowledge as such, consists of nothing but an accumulation of fact.

Yet a little reflection will show that modern science itself, which seems at first glance to have discarded all historical and traditional forms of thought, is only the latest stage in an evolution of ideas which begins before Socrates and Plato and is already well advanced in Aris-

tote. The man who expresses those ideas today with no consciousness of their origin and motives is to some degree an unconscious mouthpiece; and thus far, we may say, lacking in culture. But what is thus true of science is true even more conspicuously of political and social institutions and of literary and historical movements. Any serious study of these things is a study of the ideas and motives—broadly speaking, of the logic—underlying them. Hence, I shall not say that philosophy is pursued only in courses in philosophy. What I do say is that philosophy as such studies more explicitly than any other subject the deeper and more universal motives underlying thought and life; and therefore that among the culture subjects philosophy should be regarded as the keystone of the arch.

Secondly, from the point of view of intellectual discipline. I believe that philosophy is somewhat more conducive than any other study to the development of finer intelligence and insight; in other words, that it stands for a finer exercise of intelligence than mathematics and mathematical physics, which are usually regarded as the disciplinary studies par excellence. That these studies are difficult and strenuous, I shall not for a moment deny; my only question is whether the burden they impose is peculiarly a burden of intelligence—if, that is to say, we take the common view of mathematical reasoning. According to this view, the mathematical thinker develops by a method of calculation, or by a method of formal logical derivation (much the same thing) highly complex systems of relations out of certain received axioms or postulates or certain accepted scientific laws. There is nothing in the process, theoretically, that calls for personal judgment; nothing, indeed, that might not conceivably be accomplished by a mechanical device of the order of the adding machine. And when it comes to a criticism or interpretation of the bases of calculation, the

axioms, postulates, or laws, there the process of thinking comes to an end and the bases are simply taken for granted. Philosophy is an attempt to apply further analysis to just these basal ideas; philosophy takes nothing for granted. The aim of the philosopher is not only to think logically, according to rule, but to be clearly and critically conscious of his logic and of the motives underlying it. Philosophy, in brief, is an endeavor to think self-consciously and critically. To me this is the essential point in our conception of intelligence; and if "intellect" is also to stand for intelligence, it must also be what is essentially intellectual. It is also our native criterion of intelligence. An intelligent man is not so much one who is skilled in calculation as one who knows distinctly what he means and is able to grasp the meaning of his fellows; it is a distinguishing mark of intelligence to be able "to see ourselves as others see us." And the higher intelligence is the capacity for grasping the deeper and more reflective human meanings, as expressed in literature, science, and philosophy. Such intelligence is, therefore, not developed by the study of philosophy exclusively; it may be developed by any subject so far as this is a study of ideas. I say only that philosophy is somewhat more fundamentally critical than any other study; and that it is therefore somewhat better fitted to develop a capacity for critical thinking; a capacity, in other words, for understanding the motives and reasons underlying human life.

HISTORY

By DANA C. MUNRO
Professor of History

Why study history? The answer must depend upon our ideal of education. If the purpose of the college course is to fit a man to earn a living, few students, except future statesmen or diplomats, need to study history. But if the ideal is preparation for life, for the duties of citizenship, for a useful and enjoyable career, history cannot be neglected.

Each one of the great branches of knowledge furnishes useful discipline, and history cannot supplant the study of languages, mathematics or sciences, because it does not furnish the same kind of training.

In history the problems do not admit of such an exact solution as in many other subjects; but its problems are especially important for the student because they are of the same nature as the questions which confront him as a citizen. He must learn to weigh the reasons which have influenced men in their actions, to decide which policy was preferable and why, to consider the character of the leaders and the needs of the people. These are the kinds of questions which he must study concerning contemporary events if he is to vote intelligently and to be a leader of men, not a mere tool in the hands of others. Because of its subject matter history is of great importance in education. "He

who is ignorant of what happened before his birth is," according to Cicero, "always a child."

In the preceding paragraph I have spoken of the problems of history. This is because I believe that the only way to get the desired training from history is to study it through problems. The historian in his search for truth always proceeds by asking definite questions concerning the sources which he must use; who was the author, when and where did he live, how did he get his information, what are the probabilities that he is accurate, what were his prejudices, etc. It is never safe to accept a statement without exercising the utmost caution.

Through training by the use of problems the student develops this same questioning attitude so that he will not be as prone to accept whatever he reads or hears without first examining its probability and without desiring to hear the other side. The aim is not to produce expert historians but thoughtful citizens. Mere memory work in history will never do this. The student must acquire an elementary knowledge of historical method.

This historical method is of value in many other lines of work. Historical mindedness has been called the chief characteristic of the nineteenth century. Other branches of learning borrow freely from history. A professor of English literature called attention, a few years ago, to the fact that most of the courses offered in that subject were courses in history and not in literature proper. In teaching art in the universities the history is more frequently emphasized than an appreciation of art. In architecture its history is one of the most important courses. Zoology teaches the "life history" of various animals. This list might be greatly extended, because each branch of study is permeated, consciously or unconsciously, by the historical point of view. "The highest and most delicate compliment which the natural sciences pay to history

is the adoption of the historical method." History has also been given a very prominent position in education and is justly regarded as the basis of social sciences. "History, taught for a directly and immediately useful purpose to pupils and the teachers of pupils, is one of the necessary features of a sound education in democratic citizenship."

ECONOMICS

By FRANK A. FETTER
Professor of Political Economy

When half the world is at war to decide whether to spell culture with a "C" or a "K," it is somewhat rash of the *Princetonian* to raise the question as to what is liberal study. In these academic shades it may be well for each of us to exercise a tolerant spirit toward the views of others, even views that appear to us to be peculiar or mistaken. But one cannot well discuss the question proposed by the *Princetonian* without assigning some fairly definite meaning to our subject. Let us say then that liberal study is that study which liberates the spirit of the student from ignorance and prejudice, giving him insight into, and sympathy with, the world in which he lives.

If this be a true conception, it is presumptuous to claim for economics any peculiar cultural quality. Indeed there is a certain self-contradiction in the claim by any group of scholars that their particular subject is the exclusive, or the exceptionally fitting, instrument in liberal training. As who would say, Behold us, the full blown flower, the only perfect fruit, of education. It may be permissible for outsiders to say this of a subject, but culture is "noblesse" and doth "oblige" to modesty. No body of scholars becoming boastful will be taken at its own valuation as an agency for liberalizing the human spirit.

In truth it might be safer to rank the subjects in inverse proportion to their own claims. All have their virtues. The economic minded see the ideal of cultural training in breadth and range of vision rather than in minute devotion to one branch of learning. The largest economic principle is that of proportionality, by which life attains its maximum only as each element unites to form a more perfect unity. Every subject of study honestly pursued brings new outlooks, new appreciations, new riches of the spiritual life. But outside of academic halls, in the various professional and business callings, are many evidences that the more narrow one's field of study has been, the more prone is one to suffer from the illusion that he and his like are the only truly educated men. Carried beyond a certain point, any specialization, no matter how liberally it may begin, becomes illiberality, and culture changes into unculture.

In a curriculum covering sixteen years, beginning with the primary grade and leading to a college diploma, many subjects should be given some share of attention. Almost every kind of study gives mingled cultural and utilitarian results. Even the most purely literary and philosophical courses are taken by some students looking forward to applying the results in teaching, journalism, the ministry, or other occupations. The possibility of use, while not robbing a study of cultural qualities, may serve to give vitality and zest to its pursuit. Happily for the man of education, as well as for society, a large part of any college course in economics yields only psychic income. It coins no dollars, but it adds to the dignity and the joy of the individual life and helps to determine the very essence of the national civilization. What would Aristotle say of any specialization in philosophy that did not include the study of contemporary social and political conditions? Or of any cultural course in the humanities that left out the study of modern human society?

The fact that economics touches the world of reality at so many points is doubtless prejudicial to the view that it is in any measure a liberal study. It is not mere book learning, not just a closet philosophy. Its most abstract questions can be discussed only in classrooms with open windows. After leaving college, the man trained in economics finds opportunity and feels the necessity every day of his life to apply its lessons. In so far as he is a mere onlooker he is better able to understand and enjoy the great drama of industry that is constantly enacted before him. In so far as he is active in business he can better appreciate his relations to the complex industrial organism. In his function as citizen he is able to find his way better amid the mazes of facts and of contradictory partisan arguments. He can, through economic study, enter more fully into the larger life of humanity that surrounds him, a citizen of no petty class world.

A wonderful panorama of economic experience is unfolding itself today before the eyes of men. The monetary changes in the warring countries are causing wellnigh an economic revolution here. Our whole banking system has been changed in ways which are still a mystery to most of the practical bankers. Imports and exports of merchandise are altering in character and amounts. Wages and profits are rising, loans and interest rates present new problems. A revision of the tariff has been made and other tariff changes are impending because of conditions called forth by the war. The industrial organizations of whole nations are being profoundly modified. Economics makes these and the many other contemporary changes not only intensely interesting, but in large measure understandable.

Economics being helpful also in many kinds of practical work, what is to determine whether its study is utilitarian or cultural? The answer is: The spirit in which it is taught and studied; the spirit of the teacher and of the

student. Any economic course in our curriculum might be twisted now in this direction and now in that to make it a narrow trade school preparation for some special occupation. It must be admitted that there is a constant temptation to our colleges to illiberalize in this way their economic training, and that many have yielded to it. It must be recognized that many patrons and students are inclined to take only this myopic view. The workshop and countinghouse ideal of economic training has its rightful place in the world, but it is not in a college of liberal arts. The broader humanitarian aspects, the best elements of civic training, the most valuable mental discipline, the philosophic insight that these courses can give, would be thus sacrificed utterly.

But in the notable development in economic studies that has occurred in Princeton during the present university administration, the ideal of broad cultural training has always dominated. It has striven to be loyally true to the best Princeton traditions of graduate and undergraduate scholarship. The response of the students has been remarkable. The enrollment in the department is now more than two and a half times as large as it was five years ago. To express the improvement in the scholarly spirit of the students is more difficult, but it can be confidently declared that the earnestness of purpose, the spirit of fraternal cooperation with the teachers, and the quality of work done in our economic courses has steadily advanced. Never before, in these five years, has the level been so high as it is at this moment. Well might the wise words of Emerson be taken as a motto for economic study in Princeton: "The best political economy is the care and culture of men."

ART

By HOWARD CROSBY BUTLER
Professor of Art and Archaeology

Any plea for the inclusion of art among the studies proper to a liberal education must be based upon the assumption that the study of the humanities is a fundamental to the scheme of education; for art is essentially a humanistic subject.

We assume that it is desirable to know and to understand the world of men among whom we live, and that an educated man should be interested in human progress. In order to understand man, to help on his progress and to widen our own horizon we must know what man has achieved, and what he has been in the past. The studies which lead us directly to the knowledge of man's social, spiritual and mental development are those connected with the literature and art which man of past generations has left to us. Into these he has poured his mind and soul, in these are plainly reflected his religion, his philosophy, his political and social life, his ideals and his passions both base and elevated. We assume that it is not enough to study what modern historians and critics tell us about these things, and in order to be thorough in our knowledge we must come into vital contact with these records of written words and works of art.

Now it happens that the world, at least the world of

college students, is about evenly divided into two groups, on the one side those who are better able to arrive at an understanding of what man has been, and what he has done, by means of the ideas which he has expressed in language, and, on the other side, those who can better reach the same goal by observation of the objects which he has created. This latter class depend upon their visual appreciation of things, and acquire knowledge of what man has been and what he has thought in the past by the study of what he has created with his hands and brain combined.

And there is no invidious comparison here; for most of the great creative geniuses among artists and inventors belong to the latter class. The straight road to the intellect of many men of this type lies in their appreciation of form and its various combinations and of color. By appealing to their minds through these means other lines of thought are stimulated; mathematics becomes comparatively easy because they see its application in an art like architecture; history, literature and science come to have new meaning because of their intimate relation to art.

Looked at from this angle, the study of art is not only stimulative, but has a distinctly disciplinary value, and in my opinion should be pursued by both groups of students as distinguished above; by the one as a means of opening up the intellect and as a stimulative, by the other as parallel means of knowing man, and as a discipline.

No liberally educated man should walk blindly through the world of nature in which he is placed, or through the world of man's material creations from which it is almost impossible for him to withdraw himself. Wherever the active civilized man turns his eyes, he is confronted with the works of the hands of his fellows, and almost every one of these, whether it be a colonial cottage or a State Capitol, a modest engraving or a statue in some public place, has some definite relation with the past, as part

of a great evolutionary scheme. Is it enough that a liberally educated man should observe only that a building is large or small, or that a picture is "pretty" or otherwise?

The objection is often made that the study of art in college is not useful to a man in later life. The time honored answer to this hoary question is simply this: The man who devotes his education solely to preparation for his future profession or business, like the older man who endeavors to get all there is in life out of his daily bread-winning, cannot be said to be liberally educated, and is not likely to make a very valuable or stimulating citizen, or a congenial husband to a cultivated wife, or an inspiring parent to observing children, even though he does provide the cash. The liberally educated man must have an inner life besides his outer workaday life if he is to know the joy of living or be a joy to those with whom his lot is cast.

Think of the high tribute to the study of art that is being paid constantly by our most eminently successful men of affairs, our great bankers and captains of industry, in gathering collections of art that they may connect their names with them in perpetuity! This desire is certainly not affectation, nor is it wholly prompted by the love of acquisition, but it is largely an act of homage from success of one kind to success of a totally different sort. The plain citizen who has given some of his time to the study of art is in a position to enjoy the works of art that lie all about him even more perhaps than the millionaire collector; for to him the smallest object of beauty has an individual charm because he is able to connect it with a world of masterpieces.

But, as a teacher of one branch of art for nearly twenty years, I find my final proof of the desirability of the study of art in the testimony of many successful business men, brokers, manufacturers, etc., who have gone out from Princeton, after having given some attention to art

studies while undergraduates here—testimony to the added joy of working and of living because the world for them has been made a more delightful place to live in.

THE CLASSICS

By EDWARD CAPPS
Professor of Classics

If the editor of the *Princetonian* had asked me to explain why the undergraduate who seeks a liberal education here at Princeton should pursue the study of Greek and Latin to the exclusion of any other subject or group of subjects now constituting our course of study, I should have declined the invitation. I might even have demurred, firmly as I believe in the efficacy of the ancient classics, the language and the literature, in any scheme of liberalizing studies, had it been suggested that I was expected to exalt the claims of the classics upon the time and attention of the Princeton students. To do this might imply, contrary to the opinion which the members of the department hold, a derogation of the intrinsic or relative value of other subjects.

We have in Princeton a rather small group of subjects and comparatively few courses within these subjects, carefully selected out of an indefinite number of subjects and courses which might be offered; and the faculty as a whole declares that each and every one of them, if properly taught and properly studied, and if in any combination which may be made of them due regard is paid to their natural relations to each other—the fundamental and ancillary studies coming before those which depend upon or

presuppose them—is entitled to a place in a scheme of liberal studies.

Such other courses will no doubt be added from time to time as, in our opinion, are equally consistent with the programme of distinctly liberal studies which Princeton has deliberately adopted; but a vast number of others, such as fill hundreds of pages in the catalogues of some of the great undergraduate institutions of this country, will never appear in the Princeton catalogue, so long as Princeton retains her traditional place as a college of liberal culture.

In briefly discussing, therefore, the department of classics, and particularly the Greek side of it, I take two propositions for granted: first, that when in this series of articles we commend our own departments of study, it is not to be presumed that we are challenging the validity of the claims of any other; and, second, that there is here a general assent to the principle that it is the duty of the faculty, as custodian of the course of liberal studies and as guide to the young men who come to Princeton for a liberal education, to see to it, by means of definite general requirements and of specific prerequisites where such are needed, that the purpose alike of those who have established the institution, and of the parents who commit their sons to our charge, is not thwarted if we can possibly prevent it.

It may not be inappropriate to remark that the professional teacher of the classics should of all men be most catholic in his sympathies and tastes, and especially in his attitude toward the other subjects which find a place in a liberal curriculum. Was it not Plato and Aristotle and the great thinkers trained in their schools who first laid down the lines of practically all the great departments of learning that are recognized in the liberal curriculum of to-day? Was it not they, indeed, who first defined for us what a liberal education must be and may not be? The

classical teacher's training necessarily involves, apart from the indispensable study of the ancient languages themselves, an intelligent interest in, and to some extent a mastery of, the subject matter with which the extensive classical literatures deal—history, for example, political science, rhetoric, law, philosophy, mathematics, physics and biology—and more than a passing acquaintance with the social and political institutions, life and art of the Greeks and Romans.

The courses offered by the department illustrate this catholicity of interest in a rather striking degree. Although in most of the courses open to the upper-classmen the literary interest may be said to predominate, yet in just one-half of them the subject matter is history, politics, law, or philosophy. These courses could very properly be listed, as some of them are in fact listed, in the programme of these other departments, and they are profitably pursued by students who specialize in these subjects.

The department distinctly recognizes that one of its functions, and an important one, is to furnish not only a general intellectual training, but also a special fund of knowledge, which will be valuable to those who elect the departments of literature, history, politics, art, and philosophy. In the writings of the great thinkers of antiquity it has something of fundamental worth to offer, and invites the serious student, who should have learned in his freshman and sophomore years to read Greek and Latin with some freedom, to avail himself of the privilege which is open to him—of drinking at the fountainhead. How valuable the intellectual training is may be inferred from the records which the candidates for the arts degree have the habit of making, both at Princeton and elsewhere, in the competition for scholastic honors; and as to the importance, to the student of history, politics, law and philosophy, of having a firsthand acquaintance with the

fundamental writings of the ancients, we of the classical department gladly rest our case upon the testimony of these departments themselves.

In planning and conducting the elective courses of the junior and senior years, the department has constantly endeavored to keep them from becoming in any sense professional. Under the free elective system a tendency seemed to assert itself, deplored even by the advocates of the system, for each department to erect a four years scheme of graded courses which became more and more highly specialized toward the top. Whether the student desired to become a teacher or not, he was practically forced, if in his junior or senior year he elected English, let us say, to take courses designed chiefly for those who proposed to go on into graduate work. Thus studies which were liberal in themselves often became distinctly illiberal. The Princeton plan, in which specialization is not encouraged until after the sophomore year, is less liable to this perversion. But the danger exists in a subject which, like the classics, is required in the earlier years, of becoming too highly specialized. Against this possibility the department has resolutely set its face. Its electives are in no case training courses for teachers. No course is so built upon a preceding one that the latter is prerequisite to it. The motive which has guided the department in the selection of its electives, and in the method of instruction in them, is two fold: first, to offer for the man who desires to continue his classics a variety of masterpieces of intrinsic worth, so that he may extend the range of his reading and at the same time broaden his acquaintance with the several forms of literature; and, in the second place, as explained above, to give an opportunity to those who specialize in other subjects of studying at first hand treatises of fundamental importance in their several fields.

As to the studying of Greek in particular, I am un-

fortunately obliged to address myself to those only who have already had the privilege of studying it before coming to Princeton. The discipline to which they have been subjected in the preparatory school through the study of Greek has trained their minds to intellectual processes, has sharpened their logical faculties, has increased their ability to use their own language, has given them glimpses, at least, into two great periods in the world's history, has aroused their imaginative powers, and has opened their minds to some of the beauties of pure literature. The effect of this training, whether the student is himself aware of it or not, is generally apparent to his teachers in college, whatever the subject of instruction may be. But the value of this preliminary training is only realized, the previous investment of time and arduous labor turned into substantial dividends of intellectual enjoyment and increased intellectual power, through the courses of the freshman and sophomore years. By proper methods of study, and above all by enthusiastic and skillful guidance on the part of the teacher, it is possible for the well trained student to go beyond the vestibule and enter into the rich treasure house of the classical Greek literature and thought. "What would a man not give," exclaims Socrates to his judges, "if he might converse with Orpheus and Musaeus and Hesiod and Homer." The freshman may converse with Socrates about the immortality of the soul, to his own soul's everlasting profit, may travel in strange lands with Herodotus, may learn to sing the incomparable music of the songs of Sappho and Alcaeus; and the sophomore may be initiated into the immortal tragedies of Aeschylus, Sophocles, and Euripides. Are these things not worth while?

ENGLISH

By DR. J. DUNCAN SPAETH
Professor of English

In the conflict between "required" and "desired" studies—"liberal" studies which you are not at liberty to omit, and "illiberal" studies which you are at liberty to omit—English occupies a unique place. It is required in the freshman year and elective thereafter.

In spite of its admitted humanistic value, English is one of the comparatively recent arrivals in the curriculum, like biology, economics and the social sciences. But it differs from these in having entered by the old humanistic, rather than by the new scientific door. And there are still ardent believers in the ideal of liberal education and in the "cultural" value of English literature, who cannot see why you should study English at all, as a formal part of your college course. Now it is quite true that English has not the disciplinary value of the classics as generally taught, nor does it offer the fresh content of the natural sciences and the immediate contacts with experience of the social sciences.

Why then should one take English courses? What is the place of the English department in our curriculum? Perhaps this question can best be answered by remembering that all education has a threefold aim: first, to teach a man to do something; second, to teach him to know

something; third, to teach him to be something. Emphasis on the first element produces the vocational type, and this is true all the way from the kindergarten to the professional schools. Emphasis on the second element produces what we may call the scientific type, with discovery of knowledge for its own sake as the aim. In "graduate" courses as distinguished from both college and professional school courses, this purpose predominates, though of course it forms an integral part of all higher education. Where the third factor is stressed, where the aim is not primarily to produce efficient practitioners nor pure scholars but to humanize the individual, to liberalize him, to build up in him the elements of a free personality, you get the liberal type of education.

Now if we look at the place which English takes within our general scheme of studies, we shall see that these three general aims, which I will call the practical, the scientific and the cultural, repeat themselves within the circle of English studies, and the relative emphasis we put on them is determined by the liberal type of our curriculum. I. Under the head of the practical, comes the study of English as an instrument of expression, written and spoken, including Hall courses in public speaking, essay work, whether conducted by the English departments or by other departments, courses in advanced composition, etc. I think we might well go much farther in this direction, especially in encouraging literary production. The interest taken in the courses in advanced composition and the stimulus given to poetic production by Professor Noyes's Collection of Princeton Verse are signs of a new life that ought to be encouraged.

II. Under the second head comes the study of English literature as a part of the history of Anglo-Saxon culture and civilization. As Professor Munro has pointed out, much of the work in the English courses is historical in spirit. It differs from history in that the historic period

is studied as a background for the literary artist and his work. History culminates in performance, literature in expression. Elizabethan England is studied for the light it throws on Shakespeare, Chaucer's England for the light it throws on Chaucer; not only the literature but the language is studied historically. The older forms of English speech, Anglo-Saxon, Middle English, the principles of linguistic change, historical grammar, all form a part of the historic reconstruction of the past, which English scholarship shares with the historic sciences.

III. The third aspect of the study of English is the cultural or humanistic. In literature we get human experience reflected, appraised, interpreted, and the study of this experience so handed down is one of the chief elements in a liberal education. The deeper forces and tendencies of an age express themselves in the work of its poets and artists.

From what has been said, it is clear that English studies stand in peculiarly close relation to those of other departments; to the classics, from which English studies inherit the humanistic tradition. It is better to read Homer and Aeschylus in Greek than in English, but it is better to read them in English than not at all. The fear that the study of the classics in English will decrease the number of those who will study them in the original seems to me not well founded.

The familiarity of the English speaking peoples with the English Bible is what more than anything else has kept the study of Hebrew alive. The relations of English literature to history have already been touched upon. To philosophy they are in some respects even closer; in so far as the aim of literature is an interpretation of life and knowledge, it coincides with that of philosophy. But whereas philosophy is complex, abstract, intellectualized, literature is "simple, sensuous, passionate." The greatest

poets are philosophical and must be philosophically interpreted, but they are never philosophers.

“Grau, theurer Freund, ist alle Theorie
Doch ewig gruen des Lebens goldener Baum.”

The contacts of literature with the natural sciences are perhaps less obvious, but they are none the less intimate. No one can interpret modern literature from Goethe on, who has not followed the main lines of modern scientific thought, especially in biology. And in recent times social and economic thinking has not only floated but threatened to swamp contemporary literature.

The intimate connection between the fine arts and literature, itself a fine art, is obvious. The study of a contemporary painting or building will often do more than a multitude of definitions to express and explain the spirit of a literary artist or period.

It is therefore evident that the studies of the English department mediate between those of other departments. Whatever methods the other disciplines pursue, it is impossible to shut up English into a watertight compartment. Conceived in this sense English studies owe perhaps the best they have to give to other departments of human knowledge—that is a privilege they must constantly avail themselves of to perform their highest function. But undertaken in this spirit they combine what no other studies succeed in combining in the same degree. For they furnish an exercise in the pursuit of truth which is science, in the discipline of taste which is culture, in the application of knowledge which is power, in the widening of sympathy which is humanity, in the love of excellence which is nobility.

MODERN LANGUAGES

By CHRISTIAN GAUSS
Professor of Modern Language

As English is listed as a special department in our curriculum, and as French, German, Italian and Spanish are not, a number of misunderstandings have arisen about the function and place of a department of "modern languages." The name itself would seem to indicate that in some way this department is concerned with languages, whereas English and the department of classics teach yet other, and higher things. The recent movement to introduce French and German more extensively into the work of the classrooms may tend to reinforce this unfortunate impression. The Department of Modern Languages is to be sure seriously committed to this purpose of teaching the language; not however because this is the end of the department's endeavor, but because it is a very necessary beginning. It is not the end, since the teaching of a language merely, even if it be Greek or Latin, is not an important part of a university discipline any more than the teaching of elementary data of economics or history or natural science.

A Roman or Athenian lad of eight spoke Latin or Greek with a fluency which would put a classical honors man to shame, and a French or German lad of the same age has already an accent which is the despair of many

a university teacher. Yet the essentials of language, the essentials of even classical languages, are easy, since a child can master them. They must be taught, however, in any subject which deals with the expression of thought before that subject can take its place as a "liberal" study. The student, before he can proceed, must develop a certain feeling for this particular art of expression, a Sprachgefühl, for without this he will forever be a stranger to the literature which is being taught him.

One of the most significant of Renan's discoveries, and one which represents the conclusion of his great work in science, history, philology and literature, is to be found in the brief remark which this great teacher never tired of repeating to his pupils, "La vérité est dans la nuance." As our more rough and ready English cannot express this particular fine shade of meaning, we must render it by the approximation, "The truth lies in fine distinctions."

The student who enters the Modern Language Department should be prepared to continue French or German to the point where he can understand these fine distinctions in that language. The true purpose of a student of a modern language in a university, however, is not to learn a language merely. In one important respect it is precisely the same as that of the student of English or the classics, to interpret a civilization. For this reason what Professor Spaeth has said of English and Professor Capps of Greek, holds true of French or German. The student must first establish contacts with the art, science, history and philosophy of the people whose literature he is studying. In the remainder of this paper I can discuss merely a few of the similarities and slight differences which exist between "modern languages," improperly so called, and English and the classics.

University work begins not when the student begins to accumulate information, but when he begins to under-

stand and master valid methods and processes of arriving at truth, and to understand and master the art of expressing it. The modern fret for mere information, useful or useless, should be carefully distinguished from the thirst for knowledge. Education is not a process of accumulation but of integrating isolated facts or theories into a body of ideas strongly held and assuredly mastered. What rôle in this process can and should be played by, let us say, the study of French?

Before a student can be really master of a body of truth he must be aroused from "his dogmatic slumber," as the philosophers have it. It is not his lack of information that makes his education necessary so much as it is his lack of consciousness of what he knows, and of its relative or absolute value. The proper study of literature is one of the fundamentals in undergraduate education since in good literature true values are assigned to the facts of human experience. Indeed we may say that the literature of the world represents the funded experience of humanity; its rating of the value or significance of nature, of love, of death, of the individual or the collective life.

In addition, the study of any literature disengages the principles of the art of expression; in other words the principles of that difficult art of making the term correspond narrowly to its import which is the basis not only of all good writing but of clear thinking as well. In these respects literature, Greek, Latin, French, German, or English, is the most concrete and practical of all studies, stands in most immediate relation to the student's personal life, is most hopelessly utilitarian.

I utter Polichinelle's secret only because I am so strongly of the opinion that university studies are valuable only in so far as they are directly contributory to, and useful in, the process of education as defined above; in the process, in other words, of making the man consciously master of his methods of thought and way of life. Any

one of the important languages and literatures can and should find a place in this plan, but it will have educational value only so long as the student realizes its meaning and significance to him. All languages found in books are equally dead. When they fail to become alive in the student's mind they have lost all value, disciplinary or other. French and German may be as truly dead languages as Greek or Latin, and Greek and Latin as truly living tongues. The relative value of any of these literatures to the student will depend partly on the value of the civilization studied, but most of all upon the degree to which it is mastered and made vital to himself. They are not so much "liberal" studies, to use a somewhat meaningless phrase, as liberating studies and should be pursued not in order to teach him the past or present, and bind him to it, but to teach him the past or present and release him from any bondage. The student should learn French or Greek or preferably both, not in order to repeat what the French or Greeks thought, but in order to be the better able to think himself and the more fittingly to express his own conclusions. If he can study only one, I should advise him to study Greek; but to study it thoroughly with this purpose in view.

Since in so brief a space it is impossible to discuss the study of French and German except in its relation to cognate branches, the question naturally arises, will not English serve equally well? I would not wish to suggest that English is superfluous in a college curriculum or that the study of French or German can or should displace it. Indeed a man who has no interest in his own literature will rarely develop an interest in another.

I shall also waive the question whether the student will or will not more easily master English literature without special training. I wish to present only one aspect in which I believe French, for instance, to be of more value in that educational process of arousing the student from

his dogmatic slumber and making him conscious of himself and of the presuppositions on which his life is based.

Bernard Shaw has said that, to his countrymen, God is an Englishman. This tendency to adopt God into one's own nation is, to be sure, not peculiar to any one people. It is, however, natural to nearly all. Our outlook is limited. We enter life with the convictions, with the religion, the politics, the conventions of our parents and associates. Before they can really become our own we must become conscious of them. Nothing is more efficacious in this regard than to penetrate into the civilization of another great people, whose ideas and ideals, though different from our own, have none the less justified themselves. It should provide the kind of stimulus and sense of release which the sight of new fields brings to one who has always lived in a narrow room. It forces the student to that examination of the foundations of his belief through which alone he can make it truly his. Such self criticism is the beginning of education.

But perhaps I have made it all too grim a business. We have come to associate the idea of the study of literature with the idea of a sour faced, puritanical discipline. Any true education, like virtue, brings its own reward in psychic satisfaction and he who has really studied a foreign language and literature will find that he has been given the key to another great room in the house of life.

MATHEMATICS

By Dean HENRY B. FINE
Professor of Mathematics

To appreciate the claims of mathematics to be included in a scheme of liberal studies one should consider first of all what mathematics is, and the rôle it has played in the history of human thought and achievement.

The elements from which the science has been developed are a small group of concepts created to express with precision great relations among things in the complex external world. The most fundamental of these concepts is that of number, older in crude form than the beginnings of civilization itself, from which there began very early to be developed the elementary arithmetic or art of reckoning, which made commerce possible, and later the theory of numbers and algebra. The second is the concept of the elementary space relations, first formulated in the axioms and definitions of the Greek geometry. On this foundation the Greeks erected the entire structure of the elementary synthetic geometry as we have it to-day.

Then there are the concepts which lie at the basis of the analytical geometry and calculus, and which first took serviceable form in the minds of Descartes and Fermat, Newton and Leibnitz. It is chiefly to the problem of motion that they owe their origin. No other creations of the human mind have shown greater power. They enabled

Newton to prove that the motions of the planets about the sun may be explained by the same simple law that will explain the motion of an apple falling to the ground, and so "to penetrate," as Daniel Webster once eloquently said, "into the secret principles which hold the universe of God together." And from the time of Newton on they have been constantly working hand in hand with experiment in developing that great body of knowledge which we call physical science, the mathematical theory again and again leading the way, as, for example, did Maxwell's electro-magnetic theory of light lead to the wireless telegraphy.

When one also considers how largely the applications of physical science have determined the conditions of our modern life, one realizes that it is not too much to say that not only our understanding of the physical universe but also the achievements of man in putting the laws of nature to his own uses are in great part based on mathematics.

Moreover, it is the mathematician who, by analyzing the notions with which he had to deal into their elements and then building on these the whole structure of his science, has revealed to the world the requirements of exact thought and the forms of rigorous proof. To him primarily also philosophy owes the deductive logic and the elements of greatest significance in its concepts of space, time and the infinite.

The pure mathematics is a great assemblage of the finest products of free creative thinking, the most wonderful body of related thought that the world possesses. It abounds in beautiful concepts and relations, discoveries of men of rare genius and imagination. In its higher fields it partakes as much of the character of a fine art as of a science. Unhappily the greater part of it is beyond the powers of the college student, but in such subjects as the theory of equations, the theory of numbers, and projective geometry he may find illustrations of the kind of beauty

of which I speak, the quality which makes the higher pure mathematics a source of intellectual delight to the man fortunate enough to have gained his initiation into its mysteries.

The disciplinary value of the study of mathematics is generally recognized. Like all subjects which require close attention it develops habits of concentration. The precision of its concepts and the rigor of its logic compel exact thought and expression. Its problems afford practice in the application of general principles and stimulate the mind to independent and original thinking. The refinement of its notions and the beauty of the relations which unfold themselves to the student as he advances help create in him a corresponding refinement of mind, an aesthetic sense in the domain of things purely intellectual. Moreover, the ability to deal with abstract ideas with something approaching the freedom and certainty of touch with which one handles concrete things is one of the most important elements of real intellectual power. Because of their unrivalled definiteness and precision, the concepts and relations of mathematics are better fitted than those of any other subject for the development of this ability.

Thus the value of a mathematical training as a preliminary to the study of law has often been noticed. I am informed that the faculties of our best law schools find that a large proportion of their ablest students were distinguished in college for excellence in mathematics. An eminent judge recently told me that many of the best lawyers he had known had specialized in mathematics, so far as they could, in their student days. In England the Senior Wranglers of Cambridge have contributed an extraordinary number of men of the first rank to the bar and the bench. The reason for all this is not far to seek. One of the characteristic marks of the great lawyer is his profound understanding of legal principles. The prin-

ciples of law have something of the definiteness and precision of the concepts of mathematics, and the mind which has gained a firm grasp of the one set of notions should possess especial aptitude for gaining a like grasp of the other.

In the considerations which I have mentioned there is surely abundant reason to be found for the inclusion of mathematics in a scheme of liberal study. But for the benefit of the undergraduate of an uncompromisingly practical turn of mind, I am tempted to conclude with a quotation from Benjamin Franklin, himself one of the shrewdest and most practical of men: "Whatever may have been imputed to some other studies under the notion of insignificancy and loss of time, yet mathematics, I believe, never caused repentance in any, except it was for their remissness in the prosecution of them."

PHYSICS

By Dean WILLIAM F. MAGIE
Professor of Physics

The subject of physics appears in almost every curriculum of liberal studies. The study of physics trains the mind in accurate methods of thinking, and furnishes it with a store of knowledge which assists in determining a philosophy of nature, and finds applications in practical business and constructive work.

For mental training physics is not merely a subject presenting certain difficulties by which the mind is trained through mastering them. It has a specific value in that it presents the simplest, the most varied and the most numerous examples of the inductive process to be found in the whole range of the curriculum. Physics deals with the most immediate facts of observation. It expresses their relations to each other in terms of the most fundamental notions entertained by the human mind concerning things outside of itself. The application of induction to these facts is generally direct and easy; and any flaw in the reasoning or any generalizing from insufficient data is promptly detected by further observations.

In addition, the first principles thus obtained by induction can be dealt with as the postulates of a logical or deductive argument, and consequences drawn from them can be used in connection with further observations as

additional tests of the validity of the reasoning. This deductive element in the study of physics is a very large part of it, and gives to it a mathematical character, a certain exactness of form and method, which serves to develop the reasoning faculty in another way. The student of physics cannot fail to appreciate, however, that the true logical method by which he makes progress is the inductive method, that he is basing his conclusions not on postulates but on facts, and that mathematics supplies his tools, but does not determine his judgments. The mental process used is that which we employ in business and practical life, and the training that the study of physics furnishes in clear and accurate thinking is exactly of the sort that is needed for success in the work of the world.

Dealing as it does with the fundamental ideas of the external world, physics naturally developed early, and its first principles enter into all explanations of the more unusual physical phenomena and of the phenomena studied in the other sciences. It is not too much to say that, so far as the phenomena of science have received explanations, it has been by a reduction of them to actions described in terms of the fundamental principles of physics. And this it seems will always be the case. For the construction of a philosophy of nature in distinction from a mere description of nature, the study of physics will always be necessary, and the student who wishes to know not merely how the universe behaves but why it behaves as it does, so far as it is possible for us to tell why, will find that he must devote himself to the study of physics.

On the practical side physics gives information about many things which come under every one's observation and about which no cultivated man likes to be ignorant. To illustrate this by examples would be superfluous. And furthermore, as regards its more immediate applications, physics and chemistry together are the sciences upon which most of the large scale science of the age, called engineer-

ing, is based. Without the study of these sciences, and particularly of physics, the modern world would not have been possible, and is not now intelligible.

CHEMISTRY

By LEROY W. McCAY
Professor of Chemistry

Chemistry, in its present form, is a new science. Although not much more than one hundred years old it has developed to such an extent and made its far reaching significance felt in such numerous and unexpected ways that its requirement in the scheme of a liberal education is acknowledged everywhere. The nature of this beautiful science is one which never fails to arouse the interest and curiosity of the young seeker after truth. Being primarily an experimental science, a course in general chemistry is particularly well adapted in its profusion of color changes, dazzling fire displays, startling metamorphoses and appearance and disappearance of things to awaken in the sincere student a desire to grapple with Nature and disclose the secret of her workings.

There is a veritable poetry in the science for those who study it for culture's sake, while those who seek an intimate acquaintance with it for material reasons only find that, in comparison with the other applied sciences, its possibilities are boundless. So far as the applications of chemistry to the things of every day life and to the interpretation of the problems of the universe at large are concerned the merest beginnings have been made, and if we are justified in assuming that our science, which, as said,

is not much over one hundred years old, will continue to develop as rapidly as it has, one is filled with wonder at the benefits in store for future generations.

An intellectual training in chemistry promotes readiness in observation and experiment, strengthens the sense of perception, inculcates patience and improves the memory. It teaches the student to distinguish between truth and error, between realities and illusions, to think clearly and to judge without bias.

In no other science, perhaps, is there such a wealth of material for familiarizing him with the inductive method, or so wide a range presented for the exercise of his imagination. When chemistry is studied for culture's sake the method is the more important thing, for while it becomes permanently a part of the student's mode of thought the facts are often forgotten.

As a preliminary study for those who intend to enter certain of the professions chemistry is indispensable, and its importance as a basis for vocational study cannot be too strongly emphasized. It is required in the study of medicine, pharmacy and biology. It is of fundamental importance to the mineralogist and geologist, and finds wide application in agriculture and forestry. Metallurgy is an application of the principles of chemistry to the separation of the useful metals from their ores, and industrial chemistry wedded to engineering has given us the comparatively new science, chemical engineering, whose triumphs have been so widely heralded.

The importance of the applications of the science will be evident when one realizes that there is scarcely an article in common use which does not owe its existence, directly or indirectly, to some application of a chemical principle. Close your eyes, enter any room and touch at random any object, and ninety-nine times out of one hundred the object will be related somehow to one or more of the chemical industries. The pen with which I write,

my ink, my ink bottle, my paper, the green baize on which my arm is resting, the varnish on my desk, the bronze figures supporting my books, my lamp, my ash tray, the box of matches—indeed, almost all the articles on which my eye falls bear witness to the activities of the chemist.

The titanic struggle in Europe has awakened even the hitherto indifferent to an appreciation of the importance of some knowledge of the subject. Chemistry seems to be in the air, and some shrewd observers of the tendency of the spirit of the times predict that the twentieth century is to be one of chemistry and its applications.

BIOLOGY

By EDWIN G. CONKLIN
Professor of Biology

Culture is no single definite object, but a general and rather indefinite ideal. There are many kinds of culture—physical, intellectual, moral, aesthetic, religious, governmental, etc.—but each and all of these may be regarded from the standpoint of the individual or from that of society; the former we call education, the latter civilization.

First: In a peculiar sense the living world is an eternal challenge and stimulus to the powers of observation and constructive imagination. Men, women and children will watch without weariness the activities of living things; even many of the higher animals show great interest in and curiosity about moving objects which would remain unnoticed if perfectly still. Is not the attraction of the “movies” due to the fact that the movements make the pictures live? Instinctively we attribute to living beings the joys and sorrows, the fear and courage, the love and hate which we also experience; instinctively our curiosity is aroused with regard to them. The living world is a powerful and unfailing stimulus to the faculties of observation and imagination.

Second: Biology occupies a unique position among all the sciences in its cultivation of aesthetic appreciation and

broad sympathies. The naturalist is an artist in spirit if not in technique; he is thrilled by the beauty, the fitness, the mystery of organisms. With this aesthetic appreciation of nature there is mixed a broad sympathy with all living things. One of the students in the course in general biology said that before he studied earthworms he used to try to crush them on the walks, but that after he had learned something of their wonderful structure and habits, he carefully avoided stepping on them. Every ornithologist can appreciate the feelings of St. Francis of Assisi, who called the birds his brothers. The biologist's sympathies extend not merely to his humbler brothers, but his human sympathies are broadened and deepened. He recognizes his kinship not merely in body, but also in spirit to all men and he is able to understand and in a measure to sympathize with all. Hate and distrust are born of ignorance; knowledge brings sympathy. The study of biology, in cultivating aesthetic appreciation and in broadening the sympathies of men, occupies a unique place among the sciences.

First: The debt of civilization to biology is absolutely incalculable, as may be appreciated when one merely mentions the names of some of the biological sciences, as for example agriculture, animal breeding, bacteriology, experimental medicine, pathology, physiology, sanitation, etc. Indeed the very continuance of civilization depends to a certain extent upon biology; there were civilizations in the past which went down under the onslaughts of pestilence and famine as well as of war, and if our civilization is to advance it must rely upon biology to teach improved methods of warding off diseases, of increasing and conserving the food supply, and of improving the human breed.

Second: But the greatest contribution of biology to culture has been in the intellectual emancipation of man. The great theory of evolution has revolutionized all our

thinking regarding man and nature. And evolution is the distinctive contribution of biology to civilization, for it was in the living world and especially in the human realm that the doctrine of evolution came as the great emancipator from superstition and ignorance. The greatest theme of evolution is not the origin of species, nor even of life itself, but rather the oneness of all life. We also are living things and all that concerns other forms of life is of direct interest to us. In the lower organisms we see ourselves in simpler and more primitive forms; we see man from the standpoint of the whole living world and as a result we have ceased to a large extent to regard the universe as existing merely for us. Biology has changed our whole point of view as to nature and man, and it cannot be wholly omitted from any system of education which aims to impart culture.

GEOLOGY

By WILLIAM BERRYMAN SCOTT
Professor of Geology

In this age of the world no one can be called liberally educated who has not some acquaintance with the methods, aims and principal results of science. Not that an exclusively scientific training is in itself an education, far from it; but, on the other hand, science is an indispensable part of education. Among the various sciences, each of which is but one aspect of the undivided body of truth, geology has the great educational value of being a synthetic discipline, which brings together all of the physical and natural sciences for the elucidation of its own problems. Physics, chemistry, mineralogy, astronomy, zoology and botany must all be called into requisition by the geologist, and this is the reason why geology was the latest of the large scientific divisions to emerge. Not until the other sciences had reached an advanced stage of development did geology become possible.

The central geological problem is the history of the earth, from the beginning of the solar system, and its animal and vegetable inhabitants, including man himself. It is the history of a great development, an evolution, as it is technically called, and the study of it has completely revolutionized all our conceptions regarding man's place in nature and his relations to the universe. Lyell, Wallace

and Darwin were the principal agents of this, the greatest revolution in the entire record of the history of human thought, which no historian or metaphysician can with impunity neglect. Geology was not the only avenue of approach to this most far reaching and profoundly important of scientific generalizations, but it was and remains the most striking and convincing body of evidence to its truth. While the magnificent conception of development and progress, of the solar system, of the earth, of plants and animals, is the heart of geological inquiries, there are vast, outlying fields of only less interest and significance.

The structure of the earth, the arrangement of its rocks, the slow but ceaseless changes which are forever modifying its surface, the work of the atmosphere, of the river, the glacier, the sea, the earthquake and the volcano; topographical forms, such as hills and plains, valleys, plateaus and mountains, their genesis and unending modification are all within the province of the geologist. To his trained eye all beautiful scenery has an interest heightened by the story of development and change which it reveals. To him the earth is not a finished product, henceforth unchangeable, but is to be regarded as in a stage of its development with an incalculable future still before it.

The geological course at Princeton is so planned as to meet two different sets of requirements; in the first place, to supply the needs of those who desire, as thoughtful men whose main interests lie in other directions, to learn something of the methods and principal results of this science, and, secondly, to offer a training which, in connection with the graduate work, shall be adequate for those who intend to become professional geologists. Since the coming to Princeton of the great Swiss geographer and geologist Arnold Guyot (to whom Guyot Hall is a monument) more than sixty years ago, geology has held an honored place in our curriculum, and until comparatively few years ago was required of all students. Such a requirement is

no longer to be wished for, since it is impossible to pursue all of those studies which one would like to understand; only a choice among them is feasible.

Practical geology is of great importance in mining and in all the industries which depend upon raw material drawn from the earth. In a general course little can be done with this practical side more than to point out its value. The advance of material civilization depends upon the conquest of nature, a conquest which can be effected only by more and more adequate knowledge. Scientific discoveries which, when first made, seemed to have the smallest economic value, have frequently turned out to have the most far reaching significance, creating new industries and revolutionizing old ones. Hence, even from the most strictly economic standpoint, the cultivation of pure science, in which the aim is solely the discovery of new truth, is absolutely indispensable. In any adequate scheme of "preparedness," military or industrial, all branches of science must be given full opportunity, for none may be ignored with safety.

ASTRONOMY

By HENRY NORRIS RUSSELL
Professor of Astronomy

Astronomy is the oldest of the sciences; and there is probably no other whose growth has carried it so far beyond the range in which its applications are of practical value. Yet it continues to hold a place in public interest which is hardly surpassed even by the wonders of modern engineering; and, though it offers to society no hope of material returns, it obtains habitually from the community the means for the construction of instruments of research of unprecedented power and costliness.

What is it that wins for this purely scientific investigation so abundant a recognition in the present eminently practical age? The very same characteristics that make its study of value to the university student; notably two of them, the intrinsic interest of its subject matter, and the influence of its revelations upon our philosophy.

It is hardly necessary to expatiate upon the first of these points. Every educated man should know and desire to know something about the great universe which surrounds the little planet upon which we live; something of its overwhelming extent in space and time; something of the nature of its constituent parts, the laws that govern their relations with one another, and the influences which they exert upon us; and perhaps most of all, what are the prob-

abilities that this earth of ours will remain habitable, and whether there may be other worlds, peopled like our own by living beings, either within our solar system or in the remoter depths of space.

How deeply the knowledge of these things has influenced our philosophy, we may perhaps realize by conceiving a world without astronomy, which would not be a world lacking our present scientific development along other lines, but merely one so wrapped in clouds that neither sun nor stars were ever visible. Barring some difficulties in measuring time accurately and in navigating the seas, life would go on upon such a planet just as on our own. But how different would be the intellectual outlook! The world of men and their affairs would be our universe; this tiny corner of our cosmos would expand in our conception to constitute the whole; and all our philosophy would be centred upon ourselves and our own welfare.

Surely the university man can ill afford to ignore the science which alone shows us ourselves in our true proportion to the powers which surround us.

But there is another value of astronomical studies and one bearing very directly on its value in the university curriculum, which must not be passed over. It is not only—indeed, not chiefly—the results of astronomical investigation which possess value for the student. The methods by which they are attained are of as much interest and as much value as their results can be. We astronomers are sharply limited in comparison with our colleagues of the other sciences. We cannot experiment; we can only observe things as they happen, receiving only such information as may be carried by light through space; and often indeed must we disentangle from the observed effects the intertwined action of several simultaneously acting causes. To accomplish this often demands intellectual ingenuity of a very high order. Yet it is a for-

tunate feature of astronomy that the methods thus employed are rarely very difficult. A very modest amount of study on the part of an average student suffices to give him a real understanding of the way in which results have been attained which at first sight seem utterly inaccessible.

In the active and rapidly advancing field of stellar astronomy, in particular, it is possible to conduct even the undergraduate student to the very frontier of existing knowledge, discussing discoveries and problems which a year before were without the realm of the known.

There is in fact so much material to be discussed that more than once in the last ten years work has been done by undergraduates in this university which represented real (though naturally small) additions to the sum of human knowledge: the discovery of a comet; the calculation of the orbit of a double star; observations of stars which vary in brightness; and the like. For the student of serious scientific interests, therefore, there is no subject in which he may more readily obtain an appreciation of the actual method and spirit of research than in astronomy.

PSYCHOLOGY

By HOWARD C. WARREN
Professor of Psychology

In the work we take up after graduation some of us deal with machinery, most of us deal with books, but all of us deal with men. Contact with our fellows is the supreme fact of our daily lives. We must work with some men and perhaps work against others. It is of vital importance for our success that we learn to understand them and know how to meet their moods, attitudes, and personality. Psychology teaches us to understand men.

In selling ribbons or real estate, cattle or automobiles, to know the fine points of our wares is only half the story—the other half is to size up our customer. In the office it is not enough to be “on to our job”; we must be on to our employer too, if we want to succeed. When we rise to a position of authority we must understand those who are under us in order to get the best results out of them.

Some of us will take up a professional career. If we are teachers we must know the human mind. The teacher aims to impart knowledge to human beings; and however well he may understand his own branch, if he does not know how to make others understand it, he will prove a dead failure. Or are we going into the ministry? The priest or preacher must know the weaknesses of his flock if he is ever to help them overcome these deficiencies.

The physician does not cure by drugs alone. Suggestion plays an important part. Many of our ailments are due to depression and nervous disorders, and to cure these we must understand the mind of man. The lawyer and the judge must know human nature from the bottom up. In the interests of justice they should be able to distinguish the culprit from the feeble-minded.

Lastly the man of leisure—or the busy man in his leisure moments—must understand those whom he meets socially. It is no small satisfaction to “see through” the stuccoed hypocrite or the fur lined cad. Perhaps it is more useful to pick out congenial friends without waste of time. In whom may we safely confide and with whom should we be discreet? Only a knowledge of human nature can tell us.

Not only does psychology teach us to know others, but it helps us to know ourselves—to strengthen some of our weaknesses and to make the most of our talents. Since the days of the old Greek culture the cry has been: “Know thyself!” But what mirror is there in which a man can see his own mind reflected? To-day psychology is developing “vocational guidance” tests, which indicate in a broad way the lines in which an individual is likely to succeed and those in which he will stand at a disadvantage with others. These are precise tests based on accurate knowledge of mental principles, quite different from the shrewd guess work of the ordinary adviser.

Psychology is a liberal education in itself. If we wish to study it for its own sake, what varied fields lie before us! The psychology of advertising shows us how the successful merchant proclaims his wares. In education the study of mental tests enables us to grade children according to their degree of intelligence. In criminal law the problem of feeble-mindedness as a cause of crime deserves more emphasis. Already in some of our courts a psychologist is employed to test prisoners for mental inferiority. In

medicine, the field of mental disease is sadly understocked; the general practitioner knows nothing about "psychiatry." Finally, the social worker and the pastor must seriously face the problem of how far the vice and poverty they meet with are due to inborn depravity and how far they are due to pernicious environment. How much is there in humanity to uplift? And how can the uplift be brought about?

Apart from its bearing on our chosen career, the study of psychology broadens us and provides a culture element which otherwise is lacking. How much truer a view of life do we gain when we know that there are ten senses instead of the traditional five! What possibilities of self-development when we study these additional senses! A knowledge of the kinesthetic sense and its laws will assist us in golf, in active games and sports of every kind. Even the more familiar senses when studied systematically yield wider viewpoints.

Our artistic appreciation is sharpened if we understand the principles of complementary colors and the psychological laws of harmony and fusion. To understand the causes of illusions and the principles of memory and forgetfulness is a real help in everyday life. The all-round man should be familiar with the laws of habit formation and the factors which enter into attention and voluntary control. To know the different mental types of mankind not only assists us in our intercourse with our fellows, but it broadens our conception of human nature itself.

For one and all, psychology is the fundamental study to prepare us for life, unless we propose to live at the pole or in the centre of the Sahara Desert.



